# ALMA Science Workshop Abstract Book

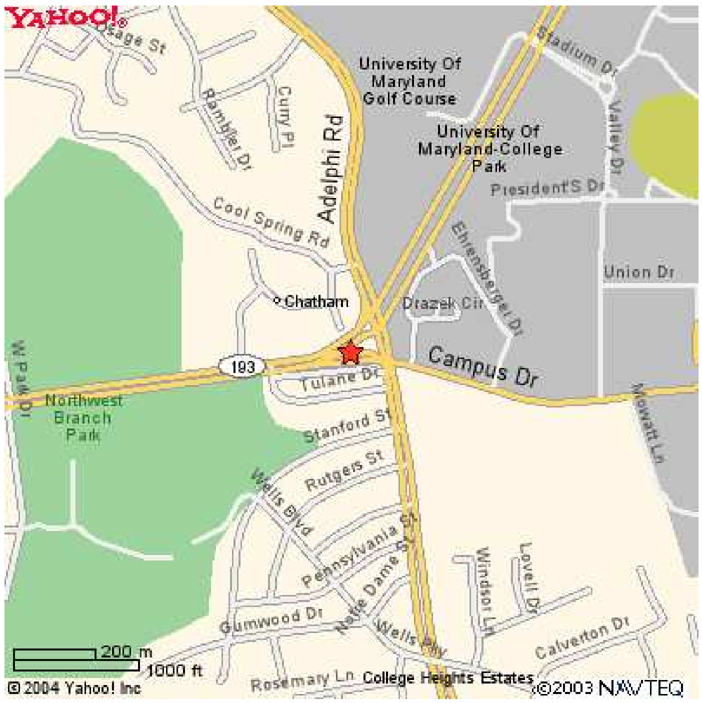
Sponsored by NRAO and the University of Maryland

14-15 May 2004

Composition: Al Wootten

# Contents

# 1 Schedule




**Map of meeting area at U. Md.**

## 2 Scientific Organizing Committee

- Chris Carilli
- Doug Johnstone
- Lee Mundy
- Yancy Shirley
- Christine Wilson
- Al Wootten (Chair)
- Min S. Yun

# 3 Local Organizing Committee

- Al Wootten (Chair)
- Lee Mundy
- Kevin Marvel
- John Trasco

# Invited Presentations

# Poster Presentations

## Finding Fast Switching Calibrators for ALMA

M.A.Holdaway NRAO/Tucson, C.Carilli NRAO/Socorro and R.Laing ESO/Garching

In order to perform fast switching phase calibration effectively, we need to have a database of bright point-like sources at millimeter wavelengths. Optimally, this would include flux measurements at 86 GHz and spectral information at higher frequencies.

We present a sample of 31100 compact flat spectrum radio sources with $-40 < \delta < +60$, presumed extragalactic, which will be likely candidates for calibrator sources. We estimate that source variability at 4.85 GHz will deliver another 2800 sources which will be likely to be bright at 86 GHz, and may pick up a few more sources from other means, so we expect our sample will stand at approximately 35000 sources.

The Prototype Interferometer (PI) at the ALMA Test Facility (ATF) may be available to verify if these sources are indeed bright at 86 GHz, thereby making an early start to a programm which will form a major part of ALMA commissioning. The sensitivity of the prototype receivers should permit a noise level of about 3.5 mJy at 86 GHz and about 10 mJy at 250 GHz. We expect about a third of the sources will be brighter than 20 mJy at 86 GHz, and these detections will be reobserved at 86, 106, 215, and 263 GHz to determine the spectrum at higher frequencies and to have some data on variability. These observations should take about 80-90 days of time on the Prototype Interferometer, and it is suggested that these observations could be done at night in the spring and fall of 2005, subject to availability of equipment and manpower.

## Atomic and Molecular Gas in Early Stage Interacting Systems

Daisuke Iono (U. Mass., CfA), Min S. Yun (U. Mass.) and Paul T. P. Ho (CfA)

We present HI and CO (1–0) observations of 10 equal-mass interacting systems obtained using the Very Large Array (VLA) and the Owens Valley Radio Observatory (OVRO). These sources are selected from previously published optical and CO (1–0) interacting galaxy surveys based on their size ($M_B \leq -19$), projected nuclear separation and the single dish CO (1–0) content ($S_{CO} \geq 20$ Jy Km/s), and the sample primarily consists of systems that have recently undergone the initial pericentric passage (i.e. early stage interacting systems). These results are analyzed in conjunction with a control sample of 20 nearby isolated systems in the BIMA SONG sample. It is found that the molecular gas in interacting systems is much more extended than in isolated systems, and that the fraction of molecular gas ($M_{H_2}/M_{gas}$) is higher in the perturbed disks. From these results and an analysis of a simulated disk-disk collision, it is inferred that the gas dissipation in the models occurs too quickly, and the validity of the assumptions and approximations made in the simulations are reviewed. A new merger sequence is proposed using 5 independent observational parameters, and this is found to be independent of the projected nuclear separation of the disks. Finally, discussion of the scientific goals achievable at ALMA is given in a context of observing gas and dust of nearby and high-z interacting systems.

## Imaging the Black Hole in the Center of the Galaxy: ALMA and submm-VLBI

Sheperd Doeleman, MIT Haystack Observatory (sdoeleman@haystack.mit.edu)

There is now abundant evidence that the compact radio source SgrA* marks the position of a massive black hole at the center of the Galaxy. Measured stellar orbits, proper motion studies, detection of polarized emission, identification of IR and X-ray flares, and sizes derived from Very Long Baseline Interferometry (VLBI) effectively rule out all but the most exotic and improbable black hole alternatives. What remains missing is the detection of an unambiguous 'event-horizon' signature and, once found, the means to study strong GR and accretion/outflow effects in the *immediate* environment of a massive black hole.

With its combination of large collecting area, mm/submm frequency range and location in the Southern Hemisphere, ALMA will be the essential element of a high frequency VLBI array capable of making detailed images of SgrA*. Use of new VLBI recording systems with bandwidths of 4 Giga-bits/second and higher will further boost the sensitivity of this VLBI array. Initial VLBI observations at 230 GHz with resolutions of 35 micro arc seconds (5 Schwarzschild radii for SgrA*) could be carried out using only a small number of ALMA dishes phased together. A fully phased ALMA array with all dishes will enable even higher frequency VLBI observations with resolutions at the 3 Schwarzschild radii level. Strong GR effects, including the 'shadow' expected to be observed as a result of light bending near the event horizon, will be targets of this VLBI array.

Building VLBI requirements into ALMA design, including the ability to phase and sum signals over the entire ALMA array, can make this Galactic Center project a unique early science result for ALMA. We discuss the scientific objectives, technical requirements, and capabilities of a submm VLBI array anchored by ALMA.

# 4 Banquet

The banquet will be held at the University of Maryland Conference Center. It will be held on Friday, 14 May, 2004. Cocktails begin at 7 p.m. with a cash bar. Dinner will be served at 8 p.m.

# 5 Abstracts and Proceedings

Abstracts for posters will be available on-line and referenced at the ADS astronomy electronic literature service. LaTeX style forms are available at the WWW site; you are now holding the booklet of posters. This booklet has been made available to participants at the Conference and electronically on the Web site of the Conference about one week in advance. A copy of the Conference Abstracts will be provided to the Astrophysics Data System (ADS).

# 6 Communication

Telephone calls and faxes should be directed to the Business Office of the Inn and Conference Center at 301-985-7652; Fax No. 301-985-7850. Incoming calls and messages should state the intended recipient is attending the astrophysics conference. Messages will be posted on a Message Board near the meeting registration area. There are pay telephones available at several locations in the Center. There is no telephone available at the registration desk.
If you are staying at the Inn and Conference Center and have a laptop computer, all lodging rooms have internet connections. Check with the Business Office (located to the left of the conference registration desk) for information on the location of other internet connections in the building. If it is more convenient, you can use the computer facilities at the Department of Astronomy; a 15-20 minute walk from the conference site. Check with persons at the registration desk for details.
Callers and those sending faxes MUST identify the fact that the message is for someone attending the ALMA conference.
The telephone number is 301-985-7652
The fax is (301) 985-7445

# 7 Thanks

Thanks to Susan Lehr for running the conference machinery, and to Pat Smiley for realization of the poster book.